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Subject:	Integrated Concerns White Paper
Date:	Thursday, August 29, 2013 9:52:09 AM
Attachments:	IA Challenges and Comments, final.docx

Chris,

The Integrated Assessment Concerns white paper we have been discussing is attached for your review. I am sure you will note that some of the items in this paper are issues that we may have discussed previously. Depending on the topic, we may have never reached a final agreement or we may have thought we had identified a satisfactory resolution, but when we started actually preparing integrated assessments we discovered that the approaches described in the ISG or indicated by our discussions on the examples were proving to be problematic. The intent of the approaches suggested in our paper is to avoid unnecessary effort (for both the industry and NRC) and to achieve consistency with approaches approved for other Fukushima response activities.

Between now and our meeting we will work on using our example of a scenario based approach to illustrate how the suggested approaches in our white paper would work.

Thank you for considering our concerns. I am looking forward to our discussions next Thursday.

Jim Riley

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Integrated Assessment

Challenges

Purpose

The purpose of this document is to articulate concerns with the Integrated Assessment (IA) triggering mechanism, the rigor and difficulty of performing IAs in accordance with the guidance contained within JLD-ISG-2012-05.

Background

The NEI Fukushima Flooding Task Force (FFTF) and NRC staff have been meeting since November 2011 to work through the response to the March 12, 2012 50.54(f) request for information. In October of 2012, the NRC published Interim Staff Guidance (ISG) on the integrated assessment process (JLD-ISG-2012-05, *Guidance for Performing the Integrated Assessment for External Flooding*). In December of the same year, additional clarification was issued in a letter on the triggers that require an IA to be performed.

The NEI FFTF began preparing an example of a scenario based mitigation evaluation using the ISG. The example's main purpose was to demonstrate the level of detail required to complete a scenario-based evaluation of a mitigation strategy. The scenario based mitigation strategy is the simplest and most deterministic of three mitigation strategy evaluation methods that can be used should protection alone not prove acceptable with margin. This process began in November 2012 and is currently on going. In addition a simple example that does not involve mitigation is also under development and consideration by the Staff. In this example an increase in water level has been calculated in the 2.1 Hazard Reevaluation Report (HRR) triggering an IA, but protection is not challenged. This process started in April 2013 and is also on going.

Concepts for Beyond Design Basis Evaluations

Throughout the course of NEI FFTF and NRC Staff meetings, it has been established that the reevaluation of the external flooding hazard requested under NTTF Rec. 2.1 will be considered a beyond design basis (BDB) condition. The reevaluated hazard results would be treated as "new information" and would not change any site's design basis criteria. If it was determined that updated the design basis is necessary, the NRC's normal processes for update would be followed (e.g. backfit, reasonable protection, etc.). These same concepts are described in further detail within NEI's letter titled "Industry Proposal on the Principles of Beyond Design Basis Regulation" dated August 15, 2013.

It is not clear that the appropriate standard for "Beyond Design Basis" (BDB) evaluations that was previously discussed in the context of HRRs is being applied to the expectations for Integrated Assessments. It is not feasible or appropriate to simply extend design basis requirements indefinitely for

conditions beyond the design basis (see NEI white paper on Principles of Beyond Design Basis Regulation). Since beyond design basis events can be essentially unbounded, are often subject to large uncertainties, and by definition are low likelihood events; they must be considered in that context. The general approach should be to provide reasonable confidence in a flexible operational capability for responding to the event, such as the approach that was used in FLEX. This "Reasonable Judgment" standard means that the rigor imposed on HRRs or IAs should be less than that used for design basis evaluations or reviews. It is not clear that the NRC is applying this concept. Specific suggestions are offered for application of "Reasonable Judgment" in the suggested approaches described below.

Introduction

As the FFTF and NRC staff continue to meet and make progress on defining criteria required to respond to the March 2012 50.54(f) request for information, several major items of concern related to the performance of integrated assessments have been identified. They include:

1. IA Triggering Mechanism and Scope
2. FLEX Mitigation Strategy as a Reliable Mitigation Option
3. Human Reliability Analysis (HRA) Breadth and Methods
4. Unrealized Graded Approach to Simple IAs

The items identified are areas where the scope of the IA remains unclear, guidance provided is contradictory and/or the methodology to perform analysis has not been adequately defined. Detailed discussion will follow for each item in the subsequent sections.

Concern 1: IA Triggering Mechanism and Scope of IA

Problem: The Staff expects that an integrated assessment will be performed on an entire flooding mechanism (such as storm surge) if the HRR contains an evaluation of an associated effect that was not clearly documented in the design basis evaluation, even if the overall design basis flood height is not exceeded.

Source of Concern:

- FAQ 017 – IA Scope: Hazards that Must be Evaluated

Introduction: The FFTF and NRC have been discussing the details and nuances that constitute the IA triggering mechanisms. There are very specific conditions analyzed under the 2.1 HRR and thus many facets to consider when deciding if a hazard has exceeded the CLB hazard levels, requiring an IA. NRC Staff published a letter offering guidance on what indeed triggers an IA on December 3, 2012, however, several FAQs and public meeting interactions have occurred and several more are planned to fully vet the triggering process.

Description: The subject of FAQ 017 (draft) warrants further clarification and discussion. The Staff has stated that if an associated effect is not discussed (i.e., is silent) in the CLB or FSAR then an IA is required for the entire flood mechanism. Since many plant's CLBs are silent on associated effects, the result of the Staff's position will be that many sites will have to perform an extensive IA when a focused assessment may be all that is necessary. The FFTF believes that a graded approach should be taken in the evaluation: if the flood mechanism can be safely accommodated by the CLB protection measures, then any new associated effects only need be evaluated to determine that they do not compromise the strategy. In other words, only the delta effects need to be included in the IA evaluation. If the evaluation of any associated effect challenges the strategy for the whole flood mechanism, then the assessment should be extended until all the challenges are evaluated. The following example illustrates our proposal.

Example: A coastal site has evaluated storm surge in the CLB but the CLB is silent on wind-driven waves (an associated effect). The 2.1 HRR finds that the combination of the new surge stillwater level and the new wind-driven waves (required under new guidance) do not exceed the CLB stillwater elevation. The FFTF proposes that the flood protection system's ability to safely accommodate the new hazard only be evaluated for the effect of the additional hazard that exceeds the CLB (in this example, the wind driven waves). In this example, effects such as the following would be evaluated:

- the dynamic loads due to the impact of the wind-driven waves on flood barriers and seals,
- the effect of the waves on the feasibility and reliability of operator actions performed outside of the flood protection barriers where the operators are exposed to the waves,
- the effect of wave action on the ability to move personnel or equipment around the site.

It is the licensee's responsibility to fully evaluate any newly identified associated effects. If any of the above or other conditions cannot be accommodated by the CLB strategy, the IA evaluation must be expanded as necessary to fully consider the condition. This may ultimately lead to a reevaluation of the complete hazard.

Suggested Approach: It is reasonable to limit the scope of the integrated assessment evaluation to initially consider only the changes introduced by the new associated effects. Similar to the position of FAQ 23 on CLB event duration, there is not sufficient justification to reevaluate the overall CLB strategy simply because the CLB is silent on an associated effect. The entire strategy for response to the flood mechanism may not have been compromised or may not deviate enough from the CLB to warrant further analysis. The following guidance should be followed.

- The flood protection features and operator responses should be evaluated to determine if they are capable of handling the conditions related to the newly identified associated effect and other hazard specific considerations that were not specifically addressed in the CLB.
- If the evaluation being performed indicates that some of the flood protection features or CLB strategies are possibly challenged, the evaluation should be extended to cover this specific change.

- If the associated effect causes the hazard or CLB protection levels to be exceeded, then the entire flood causing mechanism with the associated effect should be included for evaluation under the IA.

It is suggested that a FAQ be generated for this approach.

Concern 2: FLEX Mitigation Strategy as a Reliable Mitigation Option

Problem: The industry and the NRC are currently pursuing the mitigation strategies for BDB external events like external flooding under Order EA 12-049. The requirements of that Order include equipment and human performance attributes that the NRC has already accepted via endorsement of the industry implementation guidance (NEI 12-06) . It appears that the activities required under Order EA 12-049 are not considered sufficient for integrated assessment guidance. This contradiction in NRC positions creates confusion in the industry and will likely result in a waste of resources.

Source of Concern:

- NRC comments during meetings with the Fukushima Flooding Task Force and associated with the task force's example of a scenario based evaluation of mitigation capability

Introduction: Subsequent to the issuance of the NTTF report, the industry proposed FLEX as an approach to mitigating beyond design basis (BDB) external hazards. The fundamental premise of FLEX was that it would be a defense against postulated events that exceed the current design basis of the plant. The NRC subsequently accepted and endorsed FLEX (NEI 12-06) via Order EA-12-049.

NEI Document 12-06 states FLEX was developed to provide diverse and flexible coping mitigation strategies for beyond-design-basis external events. The strategies are to include four key elements: (1) portable equipment that provides means of obtaining power and water to maintain or restore key safety functions (2) reasonable staging and protection of portable equipment (3) procedures and guidance to implement FLEX and (4) programmatic controls that assure the continued viability and reliability of the FLEX strategies. All US sites have been ordered to develop and implement FLEX strategies in accordance with Order EA-12-049.

Description: The NRC's 50.54(f) request for information states that the reevaluations performed under Rec. 2.1 are to be considered BDB and that licensee's design basis will not be immediately changed by the reanalysis. As such, it is appropriate that licensees be able to credit the FLEX equipment and mitigating strategies that have been accepted by the NRC. Implementing interim actions and long term coping strategies should not warrant further justification up to the point where the reevaluated hazard exceeds the FLEX engineering basis. If the reevaluated hazard does exceed the FLEX engineering basis, then the FLEX equipment and associated operator actions should only need to be evaluated for the effects due to the increase in the hazard. As a simple example, if the engineering basis of the FLEX equipment is 10 feet and the reevaluated hazard is 11 feet, then the effect of the additional 1 foot of water should be assessed and considered as a design input to the use of FLEX during a BDB flooding

event. The basic capability of the FLEX equipment to mitigate a flood of up to 10 feet can be assumed based upon the acceptance of FLEX strategies in compliance to the order.

The FFTF believes that the overall effect of the IA process is to challenge FLEX strategies as reliable means to mitigate a BDB external flood event because the guidance in JLD-ISG-2012-05 largely conflicts with the flexible nature of these strategies, most notably in two key areas:

- Portable, active and temporary equipment should be evaluated to a standard outlined in Appendix A.1.2 of the ISG. The Staff has requested items such as manufacturer's failure rate, testing and maintenance data for FLEX equipment credited for flood mitigation. In many cases, FLEX equipment will not have this information available. FLEX equipment is purchased as commercial grade, and will typically have limited data beyond nameplate specifications. It will not have the same pedigree for testing, evaluation and documentation that comes with safety-related equipment. Additionally, operational experience of temporary portable equipment has not reached the level of maturity that permanently installed operating plant equipment has available to assess reliability. More importantly, requiring this data and associated evaluation for FLEX equipment that is operating within its engineering basis as described in NEI 12-06 seems to call into question the NRC's endorsement of this document which allows for the use of commercial grade equipment as a response for BDB external hazards. Specifically, page 51 in NEI 12-06 states that when specifying portable equipment, the capacities should ensure that the strategy can be effective over a range of plant and environmental conditions. This documentation should be auditable, consistent with generally accepted engineering principles and practices, and controlled within the configuration document control system. In general, FLEX documentation should be auditable but does not require Appendix B qualification. Manufacturer's information may be used in establishing the basis for the equipment use. The Staff's position seems contrary to the concept of "Reasonable Judgment" upon which the FLEX concept is based.
- The guidance for performing human reliability analysis (HRA) is described in Appendix C of JLD-ISG-2012-05. This section was written with heavy influence from NUREG-1852, which describes challenges in assessing the reliability of fire mitigation actions (a design basis evaluation). The use of the NUREG in this context should take into account the difference between design basis and BDB evaluations. Since the reevaluated hazard is a BDB event, the concept of "Reasonable Judgment" should apply to the evaluation. The NUREG and Appendix place heavy emphasis on well defined, clearly written procedures to determine that an action is feasible. The concept of FLEX is based on the ability to respond to a BDB event whose characteristics are undefined. Associated operator response procedures will necessarily rely on judgment in response to conditions experienced at the time of the BDB event. It is not possible or appropriate to perform a detailed HRA such as that described in Appendix C on this type of flexible response. Recognizing this, the FLEX guidance in NEI 12-06 does not require that level of analysis for implementing actions. In keeping with the NRC endorsement of NEI 12-06, the operator actions necessary to use FLEX equipment should not require any further analysis unless the parameters

of the HRR exceed the FLEX engineering basis. If they do, only the effect of the change in the hazard should be evaluated.

Suggested Approach: FLEX can be considered a reliable mitigation strategy for beyond design basis conditions when it is implemented in accordance with its engineering basis and the FLEX support guidance in NEI 12-06. The FLEX strategy described in the NEI document includes external flood mitigation as a consideration to provide reasonable confidence that the equipment is available and deployable under the conditions that assumed to exist during a major flood event (NEI 12-06, section 6 page 35, and section 4.2).

The following guidance should be used to evaluate any use of FLEX equipment for flood mitigation.

- FLEX capabilities should be reviewed to determine whether the new information from the reevaluated flooding hazard invalidates the boundary conditions of FLEX. In general, determine whether the strategy can be implemented under flood specific conditions, such as, access to/from equipment, connection points and timeline requirements.
- If the existing (or planned, in the interim) FLEX capability is found sufficient to mitigate the conditions introduced by the new hazard, then no further action is required.
- If the existing (or planned) FLEX capability is found to be exceeded, then the licensee is expected to either confirm that the required FLEX equipment will satisfy its credited actions under the change in conditions, or make the necessary procedural or design changes to either enhance their FLEX capabilities or establish a condition that meets the boundary conditions of their FLEX implementation.

Concern 3: Human Reliability Analysis (HRA) Breadth and Methods

Problem: Guidance for performing HRA of operator actions external to the control room is not well established. The guidance in JLD-ISG-2012-05 is based on a "Design Basis" standard as opposed to the "Reasonable Judgment" standard that is appropriate to BDB evaluations.

Introduction: Evaluating human performance and reliability for complex external event mitigation actions performed outside of the control room is an area that is just beginning to be explored. There is insufficient industry experience in these types of evaluations and consensus on how to perform HRAs with a focus on external events has not yet been established. Several documents have been published that attempt to offer guidance on factors to consider when evaluating manual actions, most recently NUREG-1852 which deals with fire mitigation actions. Appendix C of JLD-ISG-2012-05 largely borrows many of the concepts presented in NUREG-1852 which was developed for design basis events. However, major differences exist with NTTF Rec. 2.1 external flooding hazard reevaluations and design basis fire mitigation. The information obtained from the 2.1 reevaluations and subsequent mitigation strategies are not design basis events and should not be evaluated against the same standard. They generally have longer timelines with a heavy emphasis on organizational response in addition to individual actions. The guidance provided in Appendix C states that conservative bounding estimates

considering uncertainties should be used for determining that an action is reliable. This is inconsistent with the approach in NEI 12-06 and in general for mitigating BDB external events.

Additionally, it is questionable whether an HRA meeting the Appendix C requirements can be developed without actually writing and validating the hazard response implementing procedures.

Source of Concern:

- JLD-ISG-2012-05, Appendix C
- NUREG CR-1852 (Application of its principles to BDB external flooding mitigation strategies)

Description:

- Feasibility – The guidance provided in JLD-ISG-2012-05 offers many challenges to the feasibility of an action, but does not provide a repeatable, defendable methodology for determining if a manual action is feasible. For example, all 10 PSFs are given equal weight in the analysis. Each factor must be determined "nominal" to be considered feasible or adequate justification is required. There is no guidance given for the adequate justification to determine that an action is feasible given a "degraded" PSFs. In order to have consistency, throughout all IA evaluations, a methodology should be developed to determine a feasible action and guidance for acceptance despite a "degraded" rating. In addition, the guidance states that the timing analysis should use bounding time estimates with consideration for "uncertainties" in the calculation (see discussion below on uncertainties). This approach is inconsistent with BDB principles and does not allow for reasonable judgment when developing mitigating strategies.
- Reliability – JLD-ISG-2012-05 indicates that an action is only reliable when the amount of time margin available is greater than the recovery time of the action. The ISG states that if a 100% time margin is available, then the action can safely be considered reliable. Furthermore, it appears that the timing analysis needs to consider "limitations of the analysis" which we interpret as uncertainties. This criteria is inconsistent a BDB approach to reasonable judgment for operator action reliability. It requires that the smallest time window be evaluated against the maximum time required to perform the action. This is a deviation from using best estimate times to determine if operator actions in the analysis are both feasible and reliable.
  For example: FLEX equipment would likely be staged and deployed in advance of the actual flooding, as is postulated in NEI-12-06, thus providing additional margin from a HRA perspective. See 6.2.3.2 of NEI 12-06 for specific FLEX deployment wording for a flooding event. Therefore, it would seem appropriate in these cases that clearly written procedures and identification of cues would weigh more heavily towards reliability than a conservative bounding time margin estimate in concluding that an action is reliable.
- Uncertainty – The uncertainty guidance does not provide a systematic process for determining an appropriate uncertainty estimate. The guidance stipulates that bounding conservative time estimates with the consideration of uncertainty be used to determine the time margin available. This calculation is then used to judge an action's feasibility and reliability. Appendix section C.3.2.3 lists many considerations for the uncertainty and the majority deal with unexpected

conditions or unrealized challenges. This is near impossible to characterize, because if a challenge could be anticipated it would be accounted for in the procedure improving reliability.

- Training – Section C.3.1.6 indicates that training "should prepare personnel to handle departures from the expected sequences of events"; however, there is no guidance provided on how to assess whether such a standard is met.
- Operating Experience – Section C.2 of the ISG indicates that the HFE narrative should include a summary of the operating history of human errors associated with (1) establishing and maintaining the flood protection features and (2) SSCs involved in flood mitigation. Currently, there is no known collection of industry wide information related to flooding events that would make such an operating history review practical. In most cases, the flooding scenarios considered in an IA are low frequency events and a history of performance is not available because the actions have not been performed in actual conditions

Suggested Approach:

The guidance developed for flooding design basis walkdowns relied on "Reasonable Simulation" to prove that operator actions could be completed as planned. If "Reasonable Simulation" was acceptable for verifying design basis actions, it should also be acceptable for verifying beyond design basis actions as long as the simulation adequately considers the applicable BDB conditions. The approaches described below use "Reasonable Simulation" in this manner.

- Feasibility – Degraded PSFs can be accounted for by simulating their effect during a "Reasonable Simulation" of the activity.
- Reliability – If the time available to perform an action is twice the time required, an action is considered reliable. A margin of less than 2 can be justified by "Reasonable Simulation" or by evaluation.
- Timing (Feasibility and Reliability) – The timing analysis should use best estimate timing values when determining an action's time window, execution and margin. An action should be considered feasible when the window to perform the action is greater than the required time to perform the action. A reliable action should be able to show an appropriate amount of margin above the reasonable estimate. The amount of margin required should be determined based on site and strategy specific factors.
- Uncertainty – It is reasonable to discuss some level of uncertainty, however the requirement to include uncertainty into feasibility and reliability calculations in addition to upper bound timing estimates should be removed. A qualitative discussion about the factors presented in Appendix C.3.2.3 should be included to determine if any site specific factors warrants additional consideration. In addition, Reasonable Simulation" can be used to study and characterize the uncertainty in operator actions.
- Training – The training provided for the actions directed by the flooding procedure is adequate to address the conditions that may exist in flooding scenarios. For actions that may be governed by the non-flooding EOPs/AOPs/ARPs, the symptom based nature of a procedure structure is considered to be adequate to address any "departures from the expected sequence of events" and that no review of training material should be required to justify operator preparedness. The

10 PSF evaluations for each action also address any environmental impacts that the flooding event may have on the action

- Operating Experience - In lieu of an “operating history” review, any insights from plant specific timing validations, if any exist, or “Reasonable Simulation” can be considered to satisfy this requirement.